CBCS SCHEME

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15AE34

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

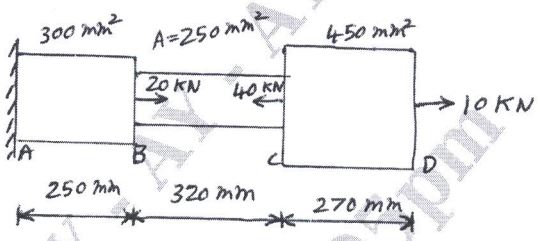
1 a. Obtain the stress components acting on an arbitrary face of tetrahedron. **(10 Marks)**

b. Explain Lame's ellipse. **(06 Marks)**

OR

2 a. A stepped bar has a fixed support at one end and loads acting are as shown in fig. Q2(a). Determine the stresses and deformations induced in each portion. Also find the net deformation induced. Take E = 200GPa. **(10 Marks)**

Fig.Q2(a)



b. A thick walled cylindrical pressure vessel has inner radius of 150mm and outer radius of 185mm. Draw a sketch showing the radial pressure and hoop stress distribution in the section of the cylinder wall, when an internal pressure of 10MN/m^2 is applied. **(06 Marks)**

Module-2

3 a. What are the Eyler – Bernoulli assumptions and its implications? **(06 Marks)**

b. An I section beam with flange dimension 180mm × 15mm and web dimension 15mm × 280mm is subjected to a bending moment of 120 KN-m and a shear force of 60KN. Determine the bending stress and shear stress distribution along the depth of the section. **(10 Marks)**

OR

4 a. What is three dimensional beam theory? Give its kinematic description. **(08 Marks)**

b. Explain the procedure to obtain the orientation of the principal centroidal axis of bending. **(08 Marks)**

Module-3

5 a. Find the diameter of the shaft required to transmit 60 KW at 150 rpm if the maximum torque is 25% more than the mean torque for a maximum permissible shear – stress of 60MN/m^2. Find also the angle of twist for a length of 4m. Take G = 80GPa. **(10 Marks)**

b. Explain Prandtl's stress function. **(06 Marks)**

OR

6 a. Determine the shear flow distribution in an open triangular section as shown in Fig. Q6(a). The section is open at point A and subjected to a vertical shear force V_3. The width and height of the section are specified in terms of wall thickness. The upper and lower halves are right triangles, whose side lengths have ratios 5:12:13. **(10 Marks)**

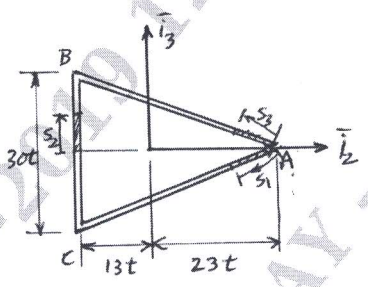


Fig.Q6(a)

b. Explain the procedure to determine the shear flow distribution over the open cross – section of a thin walled beam subjected to transverse shear forces. **(06 Marks)**

Module-4

7 a. Discuss the relationship between the equations of elasticity and virtual work principles. **(06 Marks)**

b. Obtain the joint deflection in a simple 2 bar truss shown in fig.Q7(a). Use unit load method. The truss member stiffnesses are $K_A = (EA/L)_A$ and $K_C = (EA/L)_C$. **(10 Marks)**

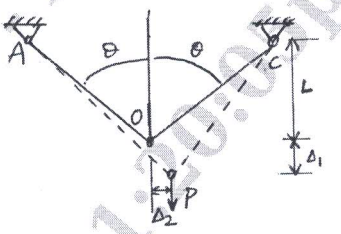


Fig.Q7(b)

OR

8 a. Define i) Castiglione's theorem ii) Clapeyron's theorem iii) Maxwell's theorem. **(06 Marks)**

b. Derive expressions for slope and deflection at the free end of a cantilever beam of length L carrying point load W at its free and using Castiglione's theorem. **(10 Marks)**

Module-5

9 a. A hollow steel tube of 50mm in diameter and 3mm thickness encloses centrally a solid copper bar of 35mm diameter. The bar and the tube are rigidly connected together at the ends at a temperature of 20^0C. Find the stresses in each metal when heated to 170^0C. Also find the increase in length, if the original length of assembly is 350mm. **(10 Marks)**

b. Explain Tresca's and Von Mises criterions. **(06 Marks)**

OR

10 a. Explain Kirchhoff Plate theory and mention its assumptions. **(08 Marks)**

b. What are the constitutive laws for laminated composite plates? **(08 Marks)**

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